Italian Botanist 19: 15–20 (2025)
doi: 10.3897/italianbotanist.19.145382
https://italianbotanist.pensoft.net

COMMENTARY

Italian Botanist
Published by Società Botanica Italiana

Some claim for the end of Botany… but what is Botany today?

Lorenzo Peruzzi[1,2]

1 *Botanic Garden and Museum, University Museum System, University of Pisa, Via Luca Ghini 13, 56126 Pisa, Italy* **2** *PLANTSEED Lab, Department of Biology, University of Pisa, Via Derna 1, 56126 Pisa, Italy*

Corresponding author: Lorenzo Peruzzi (lorenzo.peruzzi@unipi.it)

Academic editor: G. Domina | Received 26 December 2024 | Accepted 7 January 2025 | Published 21 January 2025

Citation: Peruzzi L (2025) Some claim for the end of Botany… but what is Botany today? Italian Botanist 19: 15–20. https://doi.org/10.3897/italianbotanist.19.145382

Abstract

In times of increasing interest in plants, a major challenge lies in effectively communicating the essence of Botany: What exactly does it encompass? Who are botanists? And how do botanical gardens differ from other types of gardens? To address these questions, refined definitions that account for the blurred boundaries between the fields of Botany, Agronomy, and Medicine are proposed. By representing these three disciplines in a ternary plot, I suggest defining Botany as a biological discipline where studies have a predominant (> 50%) component of basic plant science—this area is referred to here as the 'Triangle of Botany'. In this context, a botanist can be defined as a professional or scientist whose primary research focus is on basic research related to plant organisms. A botanical garden, therefore, is a space dedicated to the cultivation, conservation, study, and display of plants, based primarily on scientific principles grounded in basic research. The overlap between disciplines contributes to the communication difficulties in clearly defining what botanists do, especially when compared to professionals such as agronomists or doctors. The lack of distinct boundaries between these fields can lead the general public to misinterpret Botany and its practitioners. As a result, people may seek advice from "experts" who may not necessarily have a strong foundation in Botany. Similarly, botanical gardens are often perceived by the public as merely aesthetic spaces, akin to vegetable gardens or parks, rather than as scientifically-driven institutions. Disseminating refined definitions could help bridge the gap in public understanding of the role of Botany, fostering a clearer appreciation of this essential scientific field.

Keywords

Botanic gardens, botanist, botany, definitions, Triangle of Botany

Copyright *Lorenzo Peruzzi*. This is an open access article distributed under the terms of the Creative Commons Attribution License (CC BY 4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

Introduction

In times of increasing interest in plants (Burke et al. 2022), despite well known and documented problems of "plant blindness" especially in urbanized areas (Stagg and Dillon 2022), a major challenge lies in effectively communicating the essence of Botany: What exactly does it encompass? Who are botanists? And how do botanical gardens differ from other types of gardens?

According to the Cambridge Dictionary, Botany is defined as "*the scientific study of plants*", and the Treccani Dictionary describes it as "*the branch of Biology which studies plant organisms*". However, as contemporary plant research exhibits an abundance of specializations, the "*study of plants*" can manifest in diverse forms, often involving the "*use of plants*" or their extracts in studies ranging from basic to applied research in agronomic or medical studies, sometimes referred as "applied Botany" (Selmar and Kleinwächter 2019). This complexity certainly dates back to the origin of Botany itself as a science independent from Medicine during Renaissance (Baldassarri and Martin 2023), up to its very early origins in ancient Greece, even as a word ('botany' was coined by Homer in The Iliad, during the 8th century BC; Crisci et al. 2020). The deep connection with the cultivation of plants for food and aestethic purposes is even more ancient, dating back to at least 11,700 years ago (Carey 2023). This same complexity is also reflected in the different organization of academy, in which pure Botany is taught less and less frequently (Stroud et al. 2022, but see Colon et al. 2020; de Aguiar-Dias et al. 2023). Indeed, merely basic research is increasingly rare due to funding limitations, with applied research attracting greater financial support (Woodland 2007; Crisci et al. 2020). All these issues led some to claim for "the end of Botany" (Crisci et al. 2020) and others to highlight how basic and crucial concepts as nomenclature are increasingly neglected by the scientific community of plant biologists (Peruzzi 2020). The terms "botany" and "botanist" are becoming rare in academy, if favor of the more catchy "plant biology" and "plant biologist" (Crisci et al. 2020). In parallel, outside academy these terms are still of widespread use, but more and more often applied to any professional or amateur figure coping with plants at any level and for any reason, including Agronomy (agronomists, arboriculturists, gardeners, etc.) and Medicine (herbalists, phytoterapists, plant pharmacologists, etc.).

Blurred boundaries between botanical, agronomical and medical disciplines

Certainly, the boundaries between botanical, agronomical and medical disciplines are not well-defined, with many specialized research areas overlapping significantly. This makes almost impossible to limit the term "Botany" solely to fundamental research that expands our knowledge about plants "*per se*". However, this overlap contributes to the communication difficulties in clearly defining what botanists do, compared to more focused – although intrinsically multidisciplinary – professions like Agronomists

(Lichtfouse et al. 2009) or Doctors (Cohrs et al. 2015). The lack of clear boundaries, even within the scientific community, can lead the general public to misinterpret Botany and its practitioners. As a result, people may seek advice from "experts" who may not necessarily have a strong foundation in Botany. Similarly, botanical gardens are often perceived by the public as merely aesthetic spaces, akin to vegetable gardens or parks, rather than as scientifically-driven institutions (Chen and Sun 2018; Smith 2019). So, how to define Botany, and to distinguish it from Agronomy, and Medicine?

A refined definition for Botany, Botanist, and Botanical Gardens

If we were to represent Botany, Agronomy, and Medicine in a ternary plot, the various specialized areas of study would likely occupy the central positions, reflecting their interconnectedness (Fig. 1). Accounting for the blurred boundaries between these broad macro-disciplines, I suggest defining Botany as a biological discipline where studies have a predominant (> 50%) component of basic plant science—this area is referred to here as the 'Triangle of Botany' (Fig. 2). In this context, a botanist can be defined as a professional or scientist whose primary research focus is on basic research related to plant organisms (or research applied to nature conservation). A botanical garden, therefore, is a space dedicated to the cultivation, conservation, study, and display of plants, based primarily on scientific principles grounded in basic and/or conservation research. This refinement perfectly fits with the widely used definition by the Botanic Gardens Conservation International, i.e. "*Botanic gardens are institutions holding documented collections of living plants for the purpose of scientific research, conservation, display, and education*" (https://www.bgci.org/about/botanic-gardens-and-plant-conservation/), but better focuses on the need that the aim and criteria of the collections should be based predominantly on basic research and/or conservation.

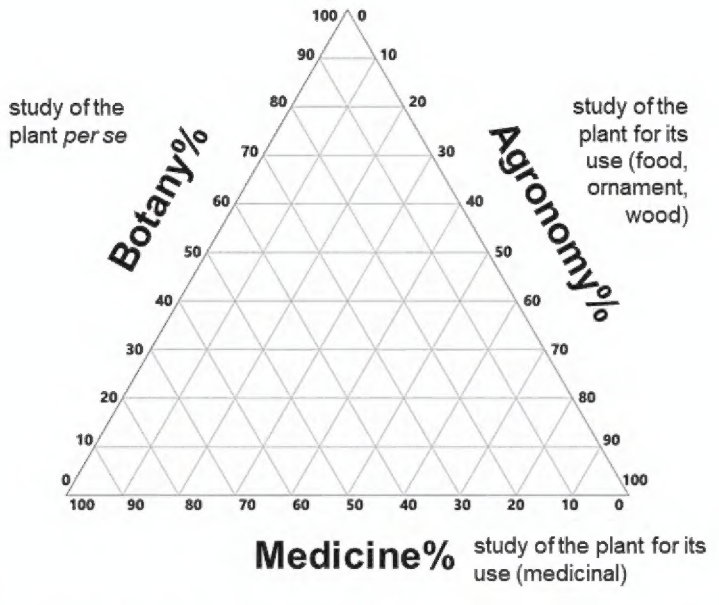
study of the plant *per se*
Botany%
Agronomy%
study of the plant for its use (food, ornament, wood)
Medicine%
study of the plant for its use (medicinal)
100 90 80 70 60 50 40 30 20 10 0

Figure 1. Ternary plot showing the relationship between Botany, Agronomy, and Medicine. A ternary plot is a type of barycentric plot that represents three variables whose sum is constant. It visually displays the proportions of these three variables as positions within an equilateral triangle.

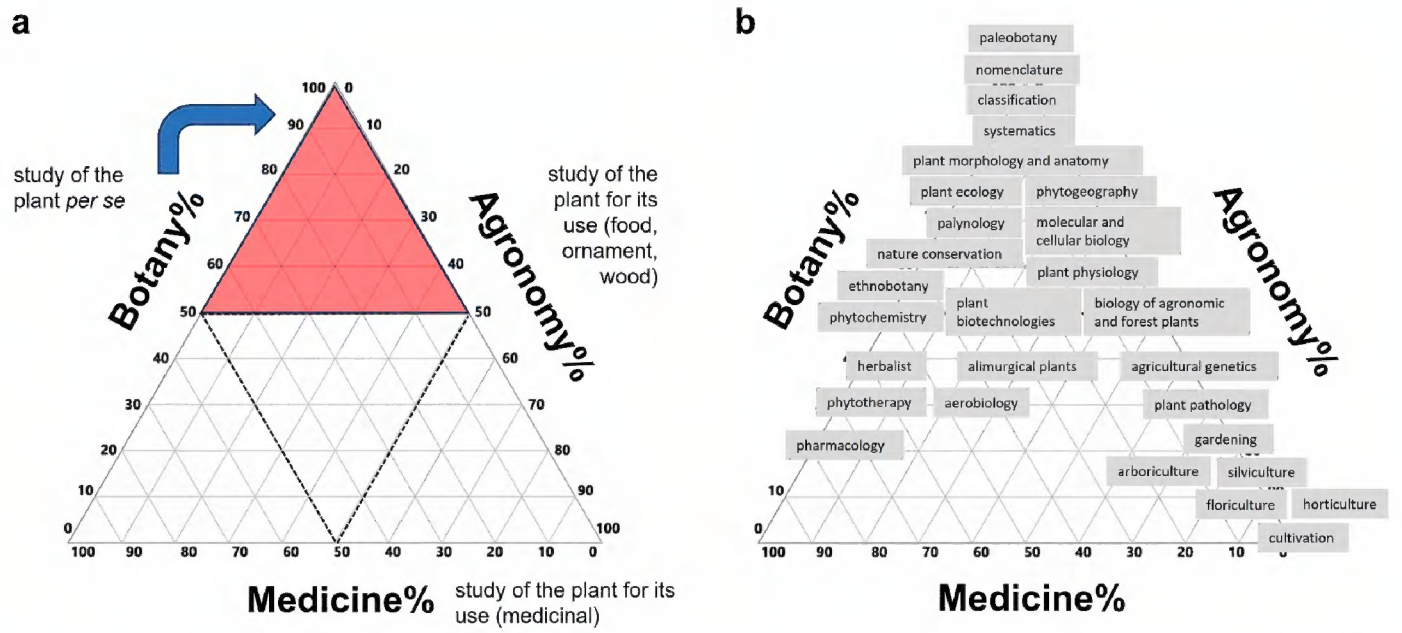

Figure 2. Ternary plot illustrating the relationships between Botany, Agronomy, and Medicine, with the 'Triangle of Botany' highlighted in red. The area of transdisciplinarity, represented by the central region, is indicated by three dotted lines (**a**). The same plot is shown with several examples of specialized research topics related to plants overlaid (**b**).

How these refined definitions could help bridge the gap in public understanding of Botany

Disseminating these refined definitions could help bridge the gap in public understanding of the role of Botany in academy, within our gardens and, by extension, within society (Smith 2019). Some possible examples are as follows:

In academy: Researchers primarily focused on studying "*the uses*" of plants, rather than plants themselves, are not botanists, but agronomists or medical researchers.

In the botanic gardens: It should be clear that a garden displaying and documenting only collections of crops is not a botanic garden, but rather a crop collection field. Similarly, a garden that displays and documents only ornamental plants is not a botanic garden, but simply a garden (or park).

In society: When a professional dealing with plants is needed, policymakers, stakeholders, the media, and the general public should ask themselves whether the expertise required pertains to knowledge about plants "*per se*" (i.e. a botanist), or "*the use*" of plants (e.g., agronomists, arboriculturists, gardeners, herbalists, phytotherapists, plant pharmacologists, etc.).

Interdisciplinarity, multidisciplinarity, and transdisciplinarity

Interdisciplinarity typically involves the integration of multiple academic disciplines into a single research activity (Nissani 1995), while multidisciplinarity refers to studying a research topic from the perspective of several disciplines simultaneously (Nicolescu 2014). However, in both cases, the research topic remains within the framework of

disciplinary research (Nicolescu, 2014), that is, within the 'Triangle of Botany' in our case. Accordingly, research topics such as phytochemistry, plant biotechnology, and the biology of agronomic and forest plants are typically interdisciplinary, while any other topic within the triangle of botany can benefit from a multidisciplinary approach. Typical examples of the latter include the relationships between botany and disciplines in the humanities, such as the connections between systematics/classification/nomenclature with the arts (the so-called botanical art, Ben-Ari 1999), or between plant morphology, anatomy, and palynology with archaeology (Day 2013).

Transdisciplinarity, on the other hand, extends beyond and integrates multiple disciplines (Nicolescu 2014). In this context, we could define interdisciplinarity in Botany as representing the central part of a ternary plot (Fig. 2), where no single discipline dominates, and all contribute roughly equally to the development of the research topic. In my view, true transdisciplinarity remains relatively rare in botany, with the study of alimurgical plants and aerobiology being two notable examples that come to mind.

What is Applied Botany?

We can distinguish three types of "Applied Botany": the first is more or less exactly situated between botany and other disciplines, but with a predominant botanical component (e.g., phytochemistry, plant biotechnology, and the biology of agronomic and forest plants); the second includes all transdisciplinary research topics (e.g., alimurgical plants, aerobiology); and the third involves research topics where agronomic or medical components are dominant. In particular, the latter cases could be more accurately defined as interdisciplinary or multidisciplinary agronomic or medical research topics, rather than as applied Botany, contrary to the suggestion of Selmar and Kleinwächter (2019).

Nevertheless, it is clear that botanical knowledge is essential even outside the discipline of Botany itself. However, reminding the scientific community and society of what Botany actually entails serves the important purpose of emphasizing the value of botanists and their research.

References

Baldassarri F, Martin C [Eds] (2023) Andrea Cesalpino and Renaissance Aristotelianism – Natural Phylosophy in the Sixteenth Century. Publisher: Bloomsbury Academic, Great Britain, 247 pp. https://doi.org/10.5040/9781350325173

Ben-Ari ET (1999) Better than a thousand words: Botanical artists blend science and aesthetics. BioScience 49(8): 602–608. https://doi.org/10.2307/1313435

Burke R, Sherwood OL, Clune S, Carroll R, McCabe PF, Kane A, Kacprzyk J (2022) Botanical boom: A new opportunity to promote the public appreciation of botany. Plants, People, Planet 4(4): 326–334. https://doi.org/10.1002/ppp3.10257

Carey J (2023) Unearthing the origins of agriculture. Proceedings of the National Academy of Sciences U.S.A. 120(15): e2304407120. https://doi.org/10.1073/pnas.2304407120

Chen G, Sun W (2018) The role of botanical gardens in scientific research, conservation, and citizen science. Plant Diversity 40(4): 181–188. https://doi.org/10.1016/j.pld.2018.07.006

Cohrs RJ, Martin T, Ghahramani P, Bidaut L, Higgins PJ, Shahzad A (2015) Translational Medicine definition by the European Society for Translational Medicine. New Horizons in Translational Medicine 2: 86–88. https://doi.org/10.1016/j.nhtm.2014.12.002

Colon J, Tiernan N, Oliphant S, Shirajee A, Flickinger J, Liu H, Francisco-Ortega J, McCartney M (2020) Bringing Botany into focus: Addressing plant blindness in undergraduates through an immersive botanical experience. BioScience 70(10): 887–900. https://doi.org/10.1093/biosci/biaa089

Crisci V, Katinas L, Apodaca MJ, Hoch PJ (2020) The end of Botany. Trends in Plant Science 25(12): 1173–1176. https://doi.org/10.1016/j.tplants.2020.09.012

Day J (2013) Botany meets archaeology: people and plants in the past. Journal of Experimental Botany 64(18): 5805–5816. https://doi.org/10.1093/jxb/ert068

de Aguiar-Dias ACA, Pinheiro SCV, Pinheiro JC (2023) "My student hates studying Botany!" about university professors and teaching of Botany. Brazilian Journal of Botany 46: 499–503. https://doi.org/10.1007/s40415-023-00898-5

Lichtfouse E, Navarrete M, Debaeke P, Souchere V, Alberola C, Menassieu J (2009) Agronomy for sustainable agriculture. A review. Agronomy for Sustainable Development 29: 1–6. https://doi.org/10.1051/agro:2008054

Nicolescu B (2014) Multidisciplinarity, Interdisciplinarity, Indisciplinarity, and Transdisciplinarity: Similarities and Differences. RCC Perspectives 2: 19–26.

Nissani M (1995) Fruits, Salads, and Smoothies: A Working Definition of Interdisciplinarity. The Journal of Educational Thought 29(2): 121–128. https://doi.org/10.55016/ojs/jet.v29i2.52385

Peruzzi L (2020) Using scientific names guarantees universality of communication in science… but are plant biologists aware of it? Plant Biosystems 154(6): 1000–1002. https://doi.org/10.1080/11263504.2020.1736203

Selmar D, Kleinwächter M (2019) Modern Applied Botany: Changes in the perception of applied botanists to themselves and others during the last century. Three recent examples of the scientific potential of this field. Journal of Applied Botany and Food Quality 92: 199–203.

Smith P (2019) The challenge for botanic garden science. Plants, People, Planet 1(1): 38–43. https://doi.org/10.1002/ppp3.10

Stagg BC, Dillon J (2022) Plant awareness is linked to plant relevance: A review of educational and ethnobiological literature (1998–2020). Plants, People, Planet 4(6): 579–592. https://doi.org/10.1002/ppp3.10323

Stroud S, Fennell M, Mitchley J, Lydon S, Peacock J, Bacon KL (2022) The botanical education extinction and the fall of plant awareness. Ecology and Evolution 12(7): e9019. https://doi.org/10.1002/ece3.9019

Woodland DW (2007) Are botanists becoming the dinosaurs of biology in the 21st century? South African Journal of Botany 73: 343–346. https://doi.org/10.1016/j.sajb.2007.03.005